

No.	Date.	G.M.T.	Position.	Aper- ture.	Exposure.	Remarks.
	1898					
22	Nov. 3	23.40	3	$\frac{1}{4}$	5 sec.	Sky getting a little white.
23	" 13	0.40	2	$\frac{1}{4}$	10 sec.	Fogged owing to accident to shutter.
24	" 13	1.0	2	$\frac{1}{4}$	10 sec.	
25	" 18	0.40	2	F.	15 sec.	Photosphere got exposed.
26	" 18	1.0	3	F.	15 sec.	Spoilt.
27	" 18	1.10	3	F.	15 sec.	Wind rising a little.
28	" 21	22.45	1	F.	15 sec.	Slight shake at opening.
29	" 21	23.8	2	F.	15 sec.	
30	" 22	Noon	3	F.	15 sec.	
31	" 27	10.25	1	$\frac{7}{8}$	5 min.	The full Moon. Excellent negative.
32	" 29	23.50	1	$\frac{1}{4}$	1 sec.	The Webster was also stopped to $\frac{7}{8}$ inch.
	1899.					
33	Jan. 4	23.45	1	$\frac{1}{4}$	$\frac{1}{2}$ sec.	

*Eclipse of the Moon, 1898 December 27.* By Rev. Walter Sidgreaves, S.J.

The night of the 27th was on the whole remarkably favourable for the physical observations connected with the passage of the Earth's shadow across the Moon's disc. The sky showed a clearness of our atmosphere seldom excelled, but often observed on the break-up of storm clouds. Our attention, however, had been confined, from the beginning, to the accurate timing of the occultations and reappearances of small stars near and during totality. But incidentally the following notes of the appearance of the Moon were made. My own impressions, with unaided eye, were:

1. That the arc-margin of the shadow as it advanced on the Moon was solid and sharp.
2. That the shadow remained dark, without colour, until the silvery-white crescent vanished at totality.
3. That after totality the change of appearances might be likened to a colour-repetition of an earlier phase; in which the dark gibbous portion assumed the colour of a copper plate after cooling down from a bright red heat, and the remaining crescent glowed with a bright yellow, about the tint of the carbon film of an electric glow-lamp when not quite "full."
4. That the bright yellow cap, as was expected, disappeared at mid-totality, and reappeared on the side of approaching light with the approaching end of totality.
5. That the contrast brightness of the eclipsed limb at the early stages of partial eclipse was as marked as on the Earth-shine limb of a new Moon.

All answers to queries put to casual observers agreed in a reddish-brown colour of the Moon when fully eclipsed, terminating in a lighter cap. Father Cortie's impressions from a telescopic view are given in his own words as follows :—

“My attention was occupied, even after the beginning of the eclipse, in the selection of a suitable eye-piece for the observation of the occultations of stars. Hence no attempt was made to time the first appearance of the shadow, nor yet its passage across the more marked features of the lunar surface. The penumbra was well seen on the Moon's limb, in the form of a crape-like gauze, for some minutes before the appearance of the umbra, into which it seemed gradually to merge. As the shadow advanced to cover the Moon, the penumbra was just noticeable extending to a distance of about one-tenth of the lunar radius along its edge. This and the following observations, except where specially noted, were all made with the 15-inch Perry Memorial telescope, using a power of 47, which had now been selected as the most suitable to give the necessary separation of the ninth magnitude stars which were to be occulted. The edge of the shadow was very dark, seemingly for about a fifth of the lunar radius, when it gradually merged into a bright reddish-copper tint. A careful search was made along the boundary of the shadow in order to detect any possible irregularities in its contour. I changed the powers for this purpose, and used one as high as 350 diameters. No irregularity was to be seen, but the extreme edge of the shadow appeared like the nap or hairy surface of cloth. All the lunar craters and seas were perfectly visible and well defined, even through the darkest part of the shadow. The first two occultations were obtained before totality was completed, and these were the best. But in all three cases of immersion which were observed, the stars seemed to eat their way into the lunar disc for a marked distance before extinction. They appeared as little yellow dots on the coppery surface, and they disappeared instantly, without the slightest lagging. After totality was complete passing clouds began to be very troublesome, so that, besides causing me to miss the greater number of occultations, the three others secured, especially the emersions, are not so reliable. About midnight, while following a star near the N. point of the Moon, which would only have been some seven minutes behind the lunar disc, I was very much struck by the appearance of a greyish-white segment of the shadow below the copper-coloured portion. In its thickest part it would not have reached as far as the crater *Plato*. It then extended into the N.E. quadrant also. Further observations were prevented by clouds. But this whitish appearance was so remarkable that I called Mr. Ronchetti to come and view it in the telescope.

“During the progress of the eclipse I had occasion to view the Moon through the 3-inch Cooke finder, attached to the equatorial. The black edge of the advancing shadow was remarkably clear-cut and regular, and during totality the coppery image appeared

to be rather more greyish in tint than when viewed with the 15-inch. To the unaided eye the edge of the advancing shadow appeared quite solid and black. The general appearance of this eclipse was in marked contrast to that of 1884 October 4, which was so dark that, had I not been following the Moon with a telescope, I doubt whether I could have picked it up without the aid of circles."

The following notes were made by Mr. James Rowland, one of my students, who observed the eclipse with the 3½-inch equatorial refractor of the Students' Observatory.

"9.55 G.M.T. Umbra well on. Edge clearly seen to be shaded off into penumbra. Limb of Moon clearly visible in deepest shadow. Colour of shadow might be described as dark sepia.

"10.8. Dark limb of Moon deep copper coloured, but more tinged with red. Preceding edge of shadow appeared darker and of a colder tint than rest (probably contrast-effect).

"10.15. Shadow becoming redder. Crater Copernicus appeared bright through shadow. Shadow still shading off, and dark limb a deep red ; but seas showed black."

"After totality much of the redness disappeared, and the colour might be described as a deep copper inclining to yellow rather than to red."

The observing arrangements for the occultations were : Father Cortie at the telescope, Mr. Ronchetti with the chronometer, and myself with the transit instrument. The latter arrangement was deemed necessary on account of the previous unfavourable weather; and fortunately the meridional sky remained clear throughout until near midnight. But the meridian passage of the eclipsed Moon was lost in the clouds.

The method of timing the occultations was the nautical method of "calling." It was at first intended to follow the eye and ear method as more exact ; but considering the chances of confusion by occultations and reappearances following close upon one another, and by the interruptions of passing small clouds, it was decided to free the observer from the task of keeping his attention on the beats of the chronometer. My own experiences at Madagascar with time signals between the Transit of Venus observatory and H.M.S. *Fawn*, led me to the conviction that the "calling" system gave a time necessarily late by about 0.2 second ; and I have not hesitated to apply this correction to the observed times of disappearance and reappearance.

The five stars observed have been identified as numbers 39, 45, 46, 32, and 39 of the Pulkova Catalogue of small stars eclipsed.

The following notes of the observer were made at the times of observation :

No. 39	Occultation.	Time very good.
45	do.	do. good.
46	do.	do. fairly good.

- 32 Reappearance. Time late ; seen close to limb, but actual reappearance missed.  
 39 Reappearance. Time fairly good.

		h	m	s
No. 39	G.M.T.	10	47	0.6
45	do.	10	51	32.2
46	do.	11	0	57.5
32	do.	11	31	39.3
39	do.	11	44	4.6

*Stonyhurst College Observatory:*  
 1899 January 10.

*Occultations of Stars during the Lunar Eclipse of 1898 December 27, observed at the Liverpool Observatory. By W. E. Plummer, M.A.*

The following observations of occultations during the eclipse of December 27, last year, were made in consequence of a communication received from the Pulkova Observatory. The conditions for observation were not very favourable. A heavy gale of wind blowing at the time interfered with the counting of the seconds of the clock, and the definition was much below the average. In consequence of this bad definition faint stars became confused with the limb when nearly in contact. As far as possible the stars have been identified with those given in the catalogue supplied by the Pulkova Observatory. It is curious that no star has been identified with those observed between 11<sup>h</sup> 24<sup>m</sup> and 11<sup>h</sup> 50<sup>m</sup>, but it is believed that the entries at the time of observation and the reductions are correct. I have nothing to add concerning the position of the observatory to that given in the *Nautical Almanac*. The power employed was 78 on an 8-inch equatorial.

*Immersion.*

Name of Star.	G.M.T. of Disappearance.	Remarks.
	h m s	
Anon.	10 43 59.5	Total phase not complete
B.D. 23° No. 1398	10 46 3.3	Very faint at limb
23 1402	10 50 5.2	
23 1403	10 59 37.4	
22 1385	11 23 59.6	Doubtful to some seconds.
Anon.	11 30 46.6	
	11 32 42.4	
	11 44 48.5	
	11 46 30.7	
	11 48 36.0	Possibly. B.D. 22° No. 1392
B.D. 22 1397	12 13 14.0	
23 1415	12 13 59.1	